AIR & LIGHT IN MACHINE SHOPS

[BLANK PAGE]

[BLANK PAGE]

INTERNATIONAL

CCA

AIR and LIGHT
in
MACHINE SHOPS

Showing Influence of Sash
Types and Building Design

"Today—The Sash Makes the Factory"

DAVID LUPTON'S SONS CO.
Weikel and Westmoreland Streets
PHILADELPHIA

CHICAGO
NEW YORK
BUFFALO
PITTSBURGH
CLEVELAND
BOSTON
DETROIT
ATLANTA

The illustration on the front cover was taken in the General Electric Co. Steam Turbine Shop at Erie, Pa. View is toward the west wall, looking north. See description, other views and and cross-section, pages 24 to 27.

FRESH AIR, proper lighting, and comfortable temperatures pay dividends in two ways.

They make the worker better contented, less liable to drift, less inclined to unreasonable demands. It is when he cannot get comfort and fair consideration that the average workman tries to square accounts by getting excessive pay. It is when pay plus working conditions are more attractive elsewhere that labor turnover becomes a problem.

But they also enable the worker to produce more. Errors are fewer; rough surfaces are sooner noticed; gauge readings are made quickly and accurately. And the dulled attention due to foul air—prolific cause of errors, accidents and slowing-down—gives place to alertness and genuine pleasure in work.

No concern that has once invested in good working conditions has ever wanted to change back. The value may be intangible, but every foreman knows that it is there.

> "It is not true that the factory building is more to blame for inefficient manufacturing than the management or the men. But it is the experience of many firms that a product, which should have been profitable, has been made at a loss because of the limitations of the factory buildings. The concerns have been well organized and skilfully managed, but they struggled along handicapped by ill-arranged, poorly adapted buildings and equipment."
>
> *W. R. Basset and Morgan G. Farrell*
> *in "Factory," May 15, 1920*

Savage Arms Corporation, Philadelphia. Wm. Steele & Sons Co., Engineers and Contractors. These two views show a remarkably well lighted and ventilated machine shop for moderately heavy work. The roof is a Pond Truss with three lines of hand-operated Pond Continuous Sash in each side. In the lower side walls Lupton Pivoted Factory Sash is used, with a line of Pond Continuous Sash above. See description and other illustrations of the Pond Truss roof, pages 14 to 21.

AIR AND LIGHT IN MACHINE SHOPS

Air—Light—Production

A tool maker is grinding an arbor. After each trial cut he takes his micrometer to the light. While he does so, both man and machine are idle.

A tool setter is adjusting the tools in a multiple turret machine. The light comes from one direction only, and he must face against it, so he switches on the electric light and stops work to adjust the drop cord. Close limits are required, and in the uncertain light the "cut and try" process is repeated several times for each tool.

In another department is a large milling machine on whose platen a score of castings are being faced on three sides at once. Some chips in shadow remain unnoticed as the operator brushes off the jigs, and a couple of castings are machined under size.

Talk with the foremen, and you will learn that the men in certain bays get tired at 3 o'clock in the afternoon. A walk through the plant shows most of the ventilators shut. Here and there some workmen has opened his ventilator wide, and in his neighborhood the air is clean and wholesome. Elsewhere the workers plod along, seemingly unconscious of the stuffiness of the air. It is no worse than they are accustomed to at home.

When the plant was designed, ventilation was not thought of as a problem. Windows were provided, and it was assumed that they would be opened. Even if only here and there, it was thought that the fresh air would diffuse itself somehow.

As a matter of fact, air does not move at all unless there is a definite force behind it. This force may be due to differences either in temperature or in pressure.

Temperature differences (between inside and outside air) are almost always present; but they are useless unless openings of sufficient area

and properly placed are provided, both for stale air to get out and for fresh air to come in. Too many manufacturing buildings show neglect of both precautions.

Pressure differences may be due to outside wind or to fans or blowers. The wind is too uncertain, and blower systems cost too much for most conditions. The real problem is to find means of both admitting and discharging air at points so located and proportioned that the result will be a slow uniform movement of air over the entire working floor, with the quickest possible exit for stale air to prevent it from returning into circulation.

To the efforts for the solution of this problem, especially in large buildings, are due most of the recent innovations both in steel sash design and in the design of the buildings themselves for the most effective use of the sash. In general, the result of this study has been to show greatly enlarged possibilities in natural ventilation for nearly all industrial uses.

Old Buildings a Handicap

While better air and light have always been needed, the problem first assumed serious proportions with the rise of intensive methods of production, and with the growth of building units to immense proportions following on the more general recognition of the economy of wide unbroken floor spaces for efficient planning and handling. This growth has shown vividly the handicap imposed by old-fashioned buildings on modern equipment and methods. Many a structure, sufficiently adapted to the easy pace of twenty years ago, is today an actual drag on production.

Whatever the "book value" of a building may be, its real value depends on its present suitability for the work done in it. A structure which would serve creditably for a basket factory may have totally outlived its usefulness as a machine shop. If used for the latter, it might better be relegated to storage, or even wrecked and written off the books, than to remain as a money waster.

The continued use of inefficient plant or equipment results not only in sacrifice of profits, but in denial of opportunity to the workers. It puts the business at a disadvantage, both in selling and in hiring. It promotes unrest, and increases labor turnover. It renders more difficult the task of establishing confidence and co-operation between management and men.

Savage Arms Corporation, Philadelphia. Wm. Steele & Sons Co., Engineers and Contractors. This building is designed for light machine work. The arrangement of upper and lower ventilators in Lupton Pivoted Factory Sash insures fresh air reaching the center bays.

"The Sash Makes the Factory"

Aside from all other features, the windows and roof sash of a shop or factory have an important influence on its usefulness, not only because both daylighting and natural ventilation depend on the sash, but because the inherent capabilities and limitations of the various types of sash fix corresponding features for the building as a whole.

The substitution of steel sash for wood made possible the glass-filled walls now familiar. Its earliest or pivoted-ventilator type was the first step toward making the building a real tool for production. For multi-story buildings it solved the daylighting problem as well as it can

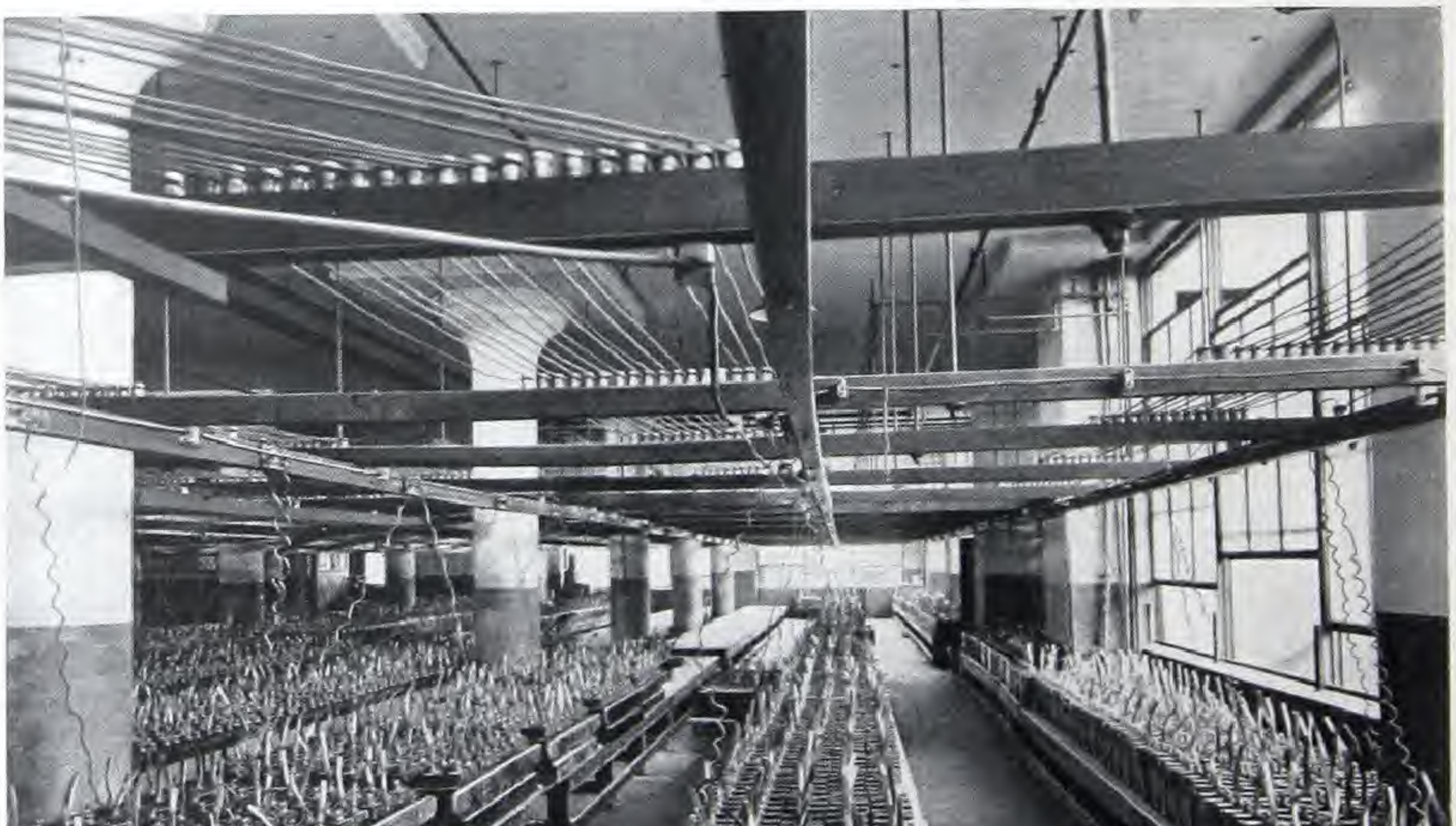
Stecker Electric Co., Detroit, Mich. Messrs. Beckett & Akitt, Architects. The well-known Eureka vacuum cleaners are manufactured here. As the building is not unusually wide and contains no heat-producing processes, ventilation presents no problems. The lighting with Lupton Pivoted Factory Sash is thoroughly modern, all parts of the first and second floors being available for accurate and rapid work. See interior view below.

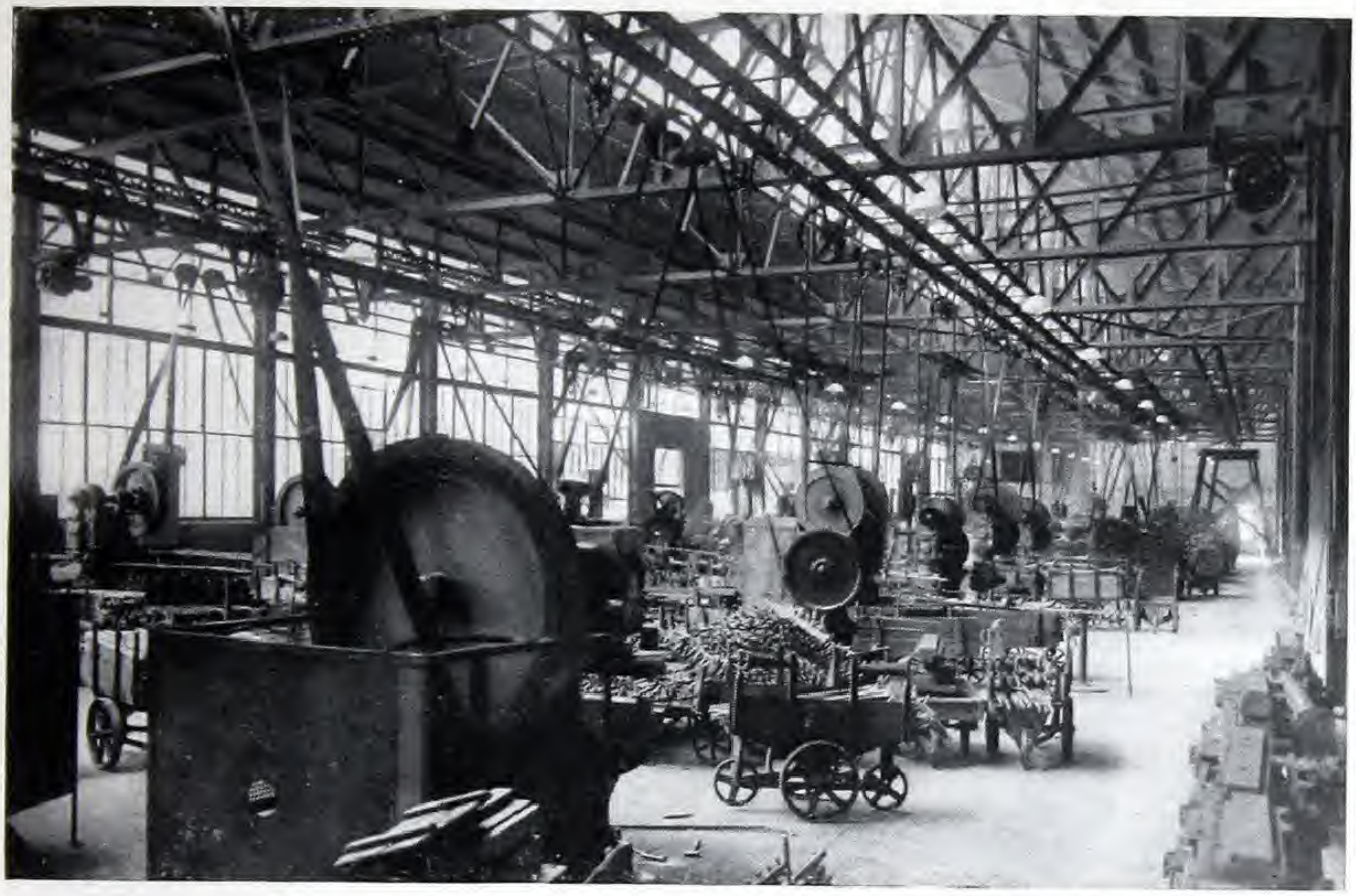
be solved; and it gave sufficient ventilation where the width of the building was not too great or the workers too crowded.

The second step was the use of "counterbalanced" steel sash. In this type the upper sash moves down as the lower sash is raised, so that an outlet is created at the top to balance the inlet at the bottom whenever a window is opened. It ensures ventilation without a cross wind, and under most conditions it will ventilate a wider building than the pivoted-ventilator type. According to whether the windows be "2-high" or "3-high," one-half or two-thirds of the glass area is available for ventilation; and the openings are always in the most effective place—*i. e.*, at the extreme top and bottom.

Electric Storage Battery Co. Addition, Philadelphia, Pa. View showing plate lugs being "burned" together by gas torches. The heat and fumes thereby produced demand abundant outlet, which is secured by using Lupton Counterbalanced Sash.

Electric Storage Battery Co. Addition, Philadelphia. Wm. Steele & Sons Co., Engineers and Contractors. Upper view shows exterior: lower view shows room where stationary storage batteries are charged. The acid fumes from charging are gotten rid of without injury to the health of the attendants by the ventilation afforded by Lupton Counterbalanced Sash. See also view on page 9.





International Harvester Corp., Plano Works. West Pullman, Ill. View in machine shop. Roof is a Pond Truss, and lower side walls are filled with Lupton Counter-balanced Sash. Above the latter a line of Pond Continuous Sash affords fresh air supply without discomfort to men on the floor in cold weather.

A New Principle in Ventilation

But neither large glass area nor the casual opening of windows here and there fulfils the whole function of steel sash. Three more things are needed:

1—Weather protection when sash are open,

2—Centralized control of ventilating openings,

3—Uniform distribution of both inlets and outlets, in order that incoming air may distribute itself uniformly throughout the building.

These needs are met by *top-hung continuous steel sash*, a type first produced in 1909 by David Lupton's Sons Co. for sawtooth and monitor roofs, and now widely applied to roofs of other types and to side walls.

Ford Motor Co., River Rouge, Mich. Blast furnace repair shop. Mr. E. B. Arnold, Architect. The lower lines of Pond Continuous Sash in the side walls and the upper lines in the monitor are operated, giving uniform ventilation by means of a few hand chains.

In its most effective form, continuous steel sash is made in lengths which are joined by waterproof, flexible expansion covers, and are so designed as to exclude rain at top and ends. It thus forms a transparent shed over a continuous adjustable ventilating opening, which may be hundreds of feet in length if desired. It combines abundant ventilation with full weather protection for property and workers.

The second feature of continuous sash—centralized control—is important because, except in summer, the workers nearest the windows can rarely be trusted to open them sufficiently to provide fresh air for those in the center bays. The former get enough air from leakage, or from a window opened here and there: but those farther back get little air unless the presence of heat or fumes forces opening of the windows. Without such compulsion, it is best to place control of ventilation in the hands of the foreman, and to make it as easy as possible by operating many ventilators, or a long line of continuous sash, at once.

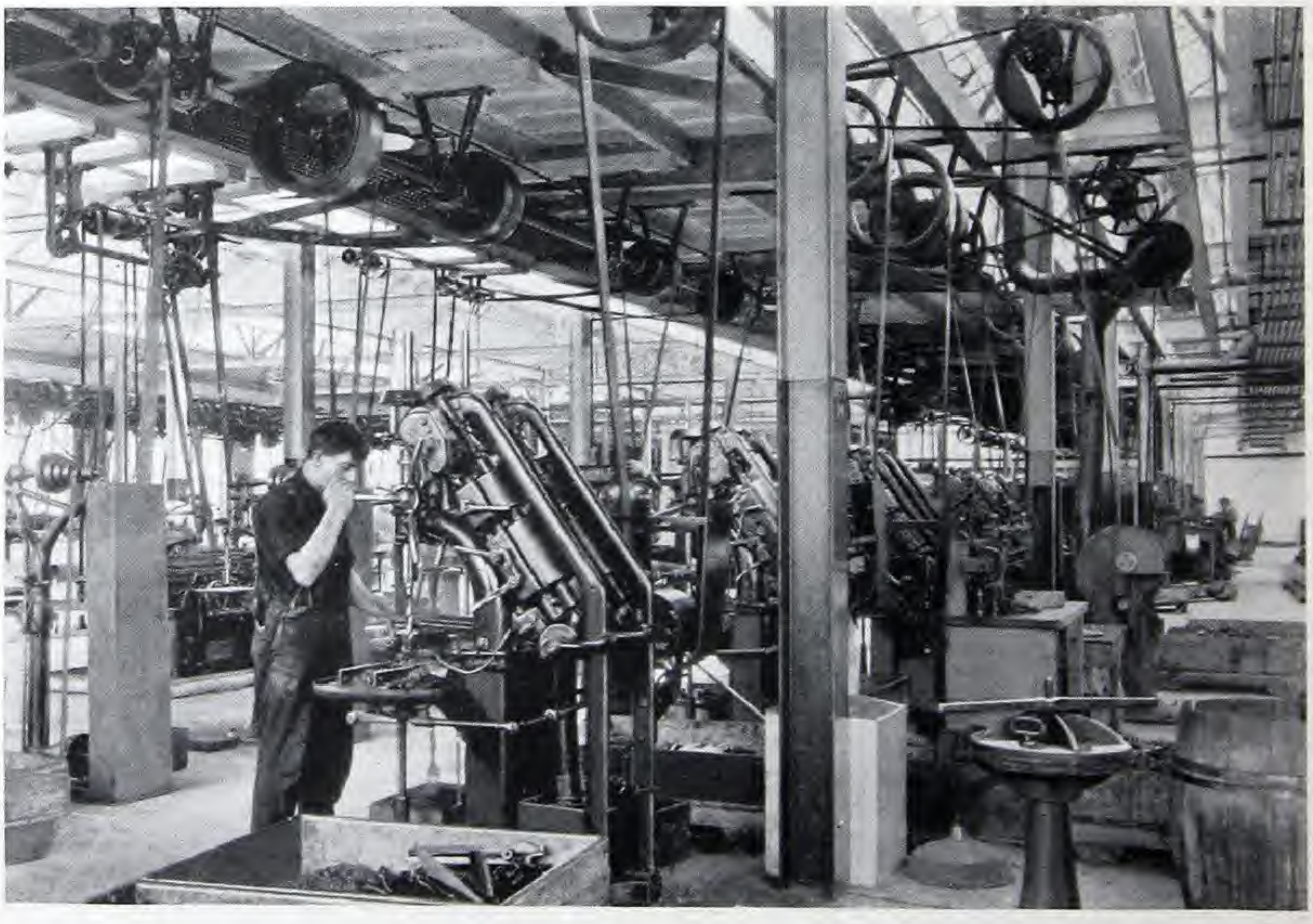
The third feature—uniformity of openings due to mass control of long lines of sash—has a special advantage. With individually-opened sash, in the hands of the workmen nearest them, haphazard opening and spotty distribution of fresh air are sure to result during the colder months. Both inflow and outflow ought to be uniform over the entire working floor; the desired object being a slow but continuous and evenly-distributed air movement, free from the alternate patches of stagnant and chilly air which lead to reduced vitality and colds.

In the development of these modern types of sash, and in their application to modern needs, David Lupton's Sons Company has had an important part.

The first counterbalanced rolled steel sash was a Lupton product: it is today known as Lupton Counterbalanced Sash.

The first continuous steel sash was Pond Continuous Sash—another Lupton product. And the first effective operating device for controlling long lines of top-hung continuous sash was the Pond Operating Device. That device is now used also for controlling lines or groups of pivoted ventilators, and possesses marked advantages for that service.

National Pneumatic Co., Rahway, N. J. Mr. Conrad F. Neff, Architect. An excellent example of design in structural steel. The two Pond A-frames down the center of the roof admit light and air, and the Pond Trusses afford outlet. As the sash lines run north and south, the morning and evening sun rays are reflected downward by the inverted roof instead of being lost, as with sawtooth or monitor roofs. View below is taken under one of the A-frames.



Interior of National Pneumatic Co. Machine Shop under one of the Pond Trusses. The inverted roof utilizes light that is wasted by conventional roofs. With a building of this type artificial lighting is seldom needed during working hours.

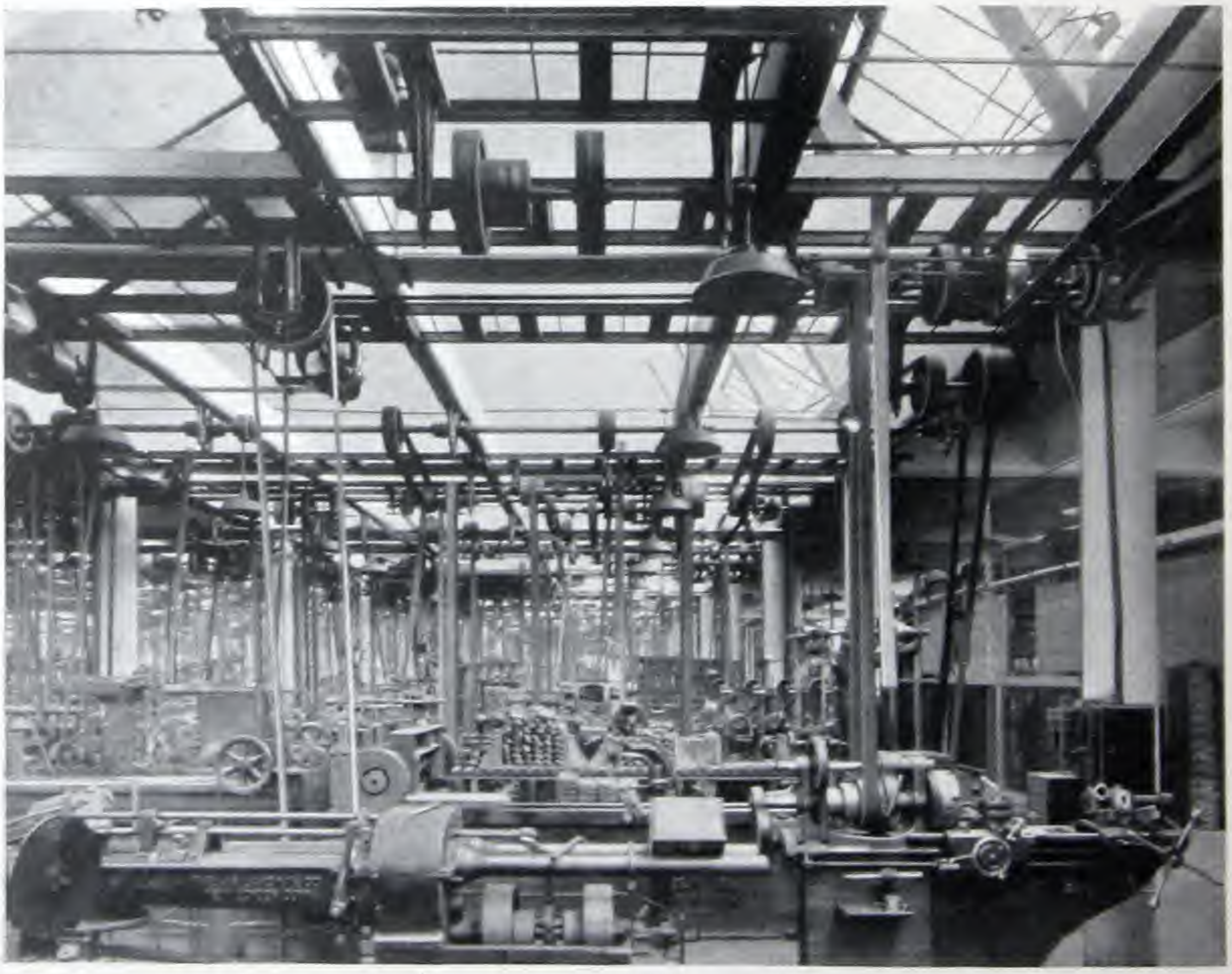
Pond Continuous Sash and the Pond Operating Device are today the most-used and best-known appliances of their kind, and their influence on certain types of building design has been revolutionary.

Fitting the Building to the Sash

Having produced certain types of sash and operators with unusual ventilating capabilities, the next move was to develop ways of using them to maximum advantage. To this end David Lupton's Sons Company has worked in close co-operation with the architect or engineer of every building presenting problems in ventilation or in daylighting.

The width and height of the proposed building, the nearness of adjacent buildings, the nature of the work, the presence or absence of heat-producing processes, the geographical location, the type of construction—these and many other factors had to be considered, in addition

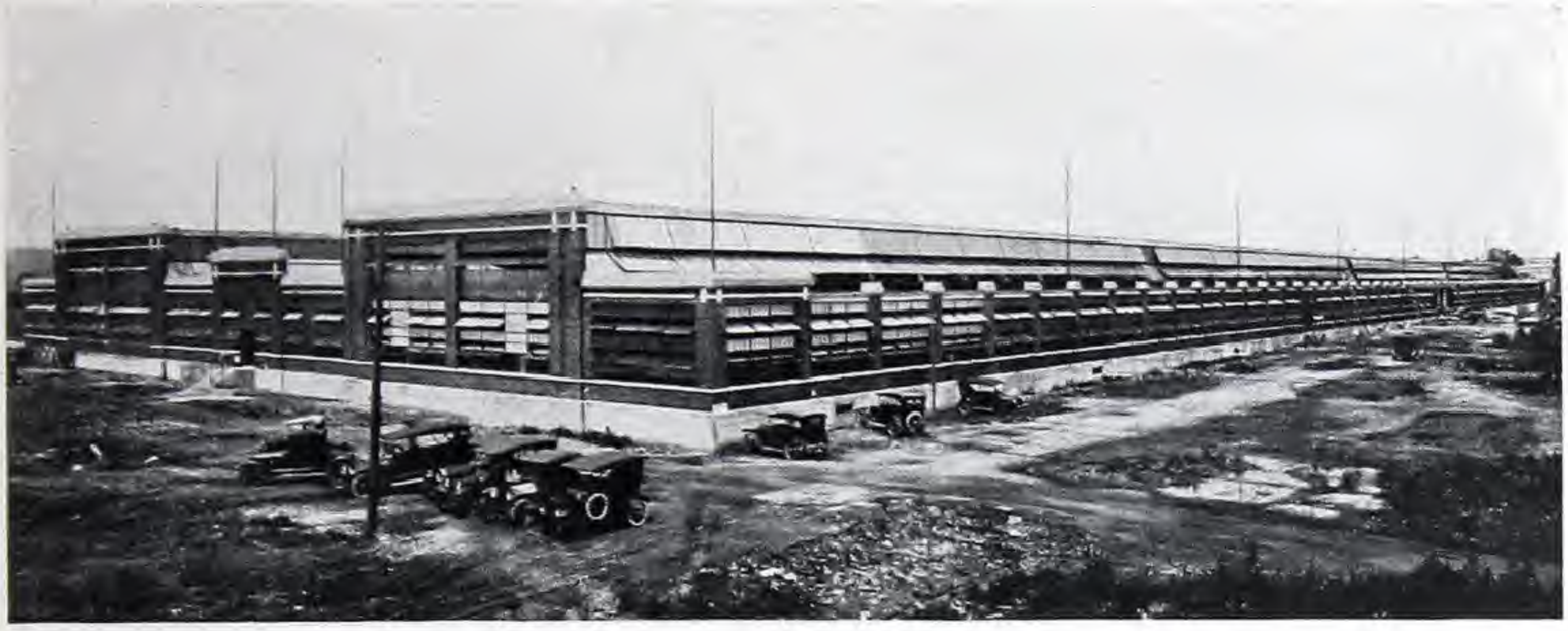
Olds Motor Works, Lansing, Mich. Mr. S. D. Butterworth, Architect. This machine shop has two Pond Trusses with low roof between, on which a Pond A-frame is placed. See view of roof opposite, and view under one side of Pond Truss below. Building is 240 ft. wide x 500 ft. long.



Olds Motor Co. Machine Shop. Upper view looks down center of roof; the Pond A-frame admits fresh air and light. Lower view: Corner of a Pond Truss. The lines of Pond Continuous Sash are balanced by spirals and counterweights, which take the load off the operating device.

Dayton-Wright Airplane Co., Dayton, O. Fuselage assembled, ready for shipment. Looking across Pond Truss.

Dayton-Wright Airplane Co., Dayton, O. In wing assembly department, under one Pond Truss.



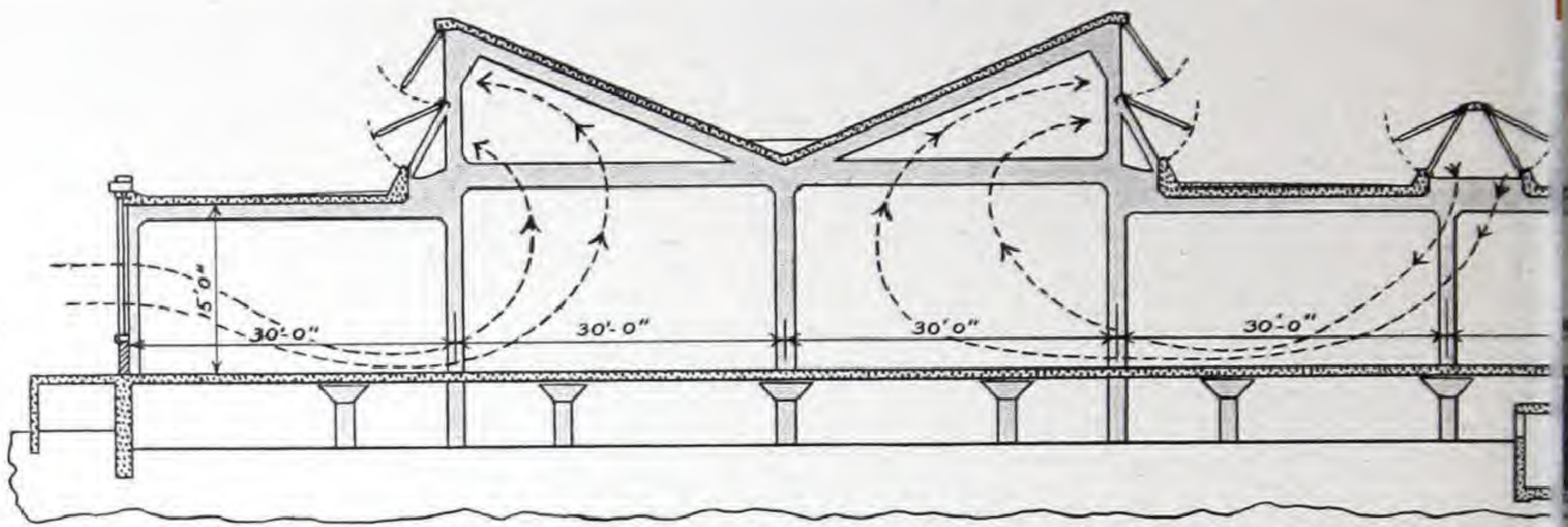
Dayton-Wright Airplane Co., Moraine, near Dayton, O. Messrs. Schenck & Williams, Architects. Mr. O. Kressler, Maintenance Engineer. Main manufacturing building: originally designed as a machine and electrical factory, and acquired for airplane manufacture during the war because of its remarkable lighting and ventilation.

to the choice of sash itself. From this experience, extending now over nearly ten years and involving hundreds of unusual buildings, certain types of roof design have been developed, and certain applications of sash to side walls, whereby results formerly thought impossible are secured.

Prominent among these new developments is a new type of roof design, by which natural air currents are created that ventilate any roof-covered floor area, no matter how extensive. With such a roof it is no longer necessary to limit the width of a building to what can be ventilated by air entering the side windows and escaping from the roof, or to resort to forced ventilation for wider floors.

Another development is the application of the mass control principle on a large scale to the windows of both single and multi-story buildings, thereby ensuring better ventilation over wide floors than by any form of individually-opened sash.

Another is more effective light distribution than is given by either the sawtooth or any of the conventional monitor forms of roof. This development alone, involving as it does both better diffusion and better use of early and late daylight, with consequent minimum use of artificial light, is of incalculable benefit to the metal working industries.



Cross section of main factory building of Dayton-Wright Airplane Co., showing course admit light and discharge air. The building was designed for later expansion by repeating t

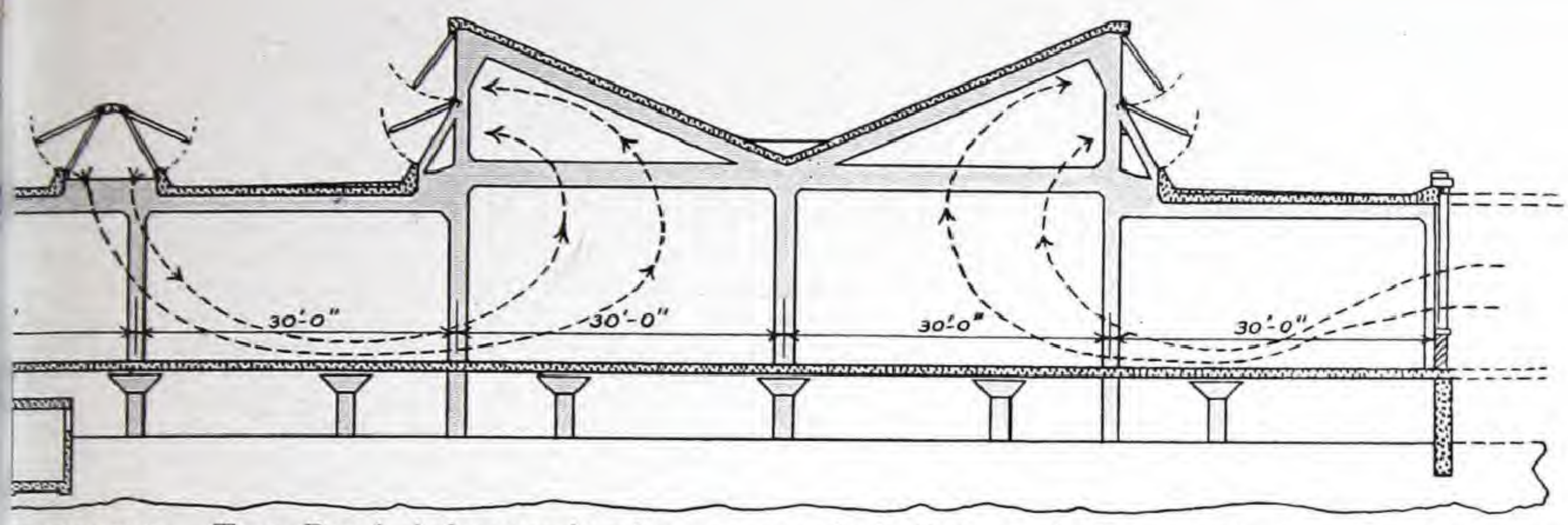
But perhaps the most important result of Lupton engineering service has been the demonstration of hitherto unrecognized possibilities in large buildings. Any building, if it be small enough, can be well lighted and ventilated; but real skill and experience are needed to combine successfully the low square-foot cost of a large building with the good air and light of the small building. By treating each building as a problem in itself, disregarding conventional forms, and applying boldly the principles of air currents found to obtain in practice, strikingly successful results have been obtained.

In the accompanying pages are shown a number of unusual machine shops, to whose design we have contributed. Both single and multi-story types are included.

The single-story building, of course, has the immense advantage that unlimited light and air are present just above it, and need only the right sort of roof to admit them within. Besides that, a one-story factory can usually be better planned for operating economy than a multi-story factory: the departments do not have to fit prescribed floor areas, and there is less loss of time in transportation between them. Further, with the right sort of roof, it is not necessary to divide the plant into a group of one-story buildings in order to get ventilation: one continuous roof can be made to admit as well as discharge air.

The Pond Truss Roof

But the roof that will do this is of no conventional form. No such form has the varying levels—low for inlets, higher for outlets—that are



r currents. Two Pond A-frames in the center admit light and air, and the two Pond Trusses
of formation to the right.

essential to create automatic air movements on windless days. Even in a wind, conventional roof types are nearly useless for wide buildings.

This deficiency is overcome, and the problem of ventilating as well as lighting a floor area of indefinite extent solved, by the type of roof shown in the cross-sectional view above. By alternating the raised outlets with low inlets, each extending the full length of the building, and protecting both with Pond Continuous Sash, a slow, uniform air movement results, which leaves no part of the floor untouched, yet which may be regulated according to the weather and season by opening the sash less or more. A building so laid out can be extended indefinitely in width or length by repeating the roof formation.

This type of roof is known as the Pond Truss. Its essential feature is the inverted or V-shaped feature, with vertical and sloping lines of Pond Continuous Sash. These slopes—of both roof and sash—are so proportioned as to lead rising heat currents as easily as possible to the outlets.

Where the building is not too wide, one Pond Truss is enough. Where the width requires it, two or more are used. The inlets between them may take the form either of the simple "Pond A-frames" shown in the photographs, or of special low roofed "fresh air bays," designed to give continuous fresh-air inlets at the lowest practicable elevation. These bays are proportioned according to the height of the main roof: they may be used for storage, toilet and locker rooms, etc., or they may contain superintendent's and timekeepers' offices under an inner roof, 8 feet high, ventilated by pipes carried up through the Pond A-frame.

The lighting effect of the Pond Truss is as unusual as its ventilation. Unlike the sawtooth, which gives a one-direction light, with harsh contrasts when facing the sash, the Pond Truss affords cross-lighting, which leaves no part of the work in shadow. When the sash lines run approximately north and south, as is recommended, maximum use is made of the morning and evening sun rays, which are wasted by the sawtooth, but are reflected downward and utilized by the Pond Truss roof.

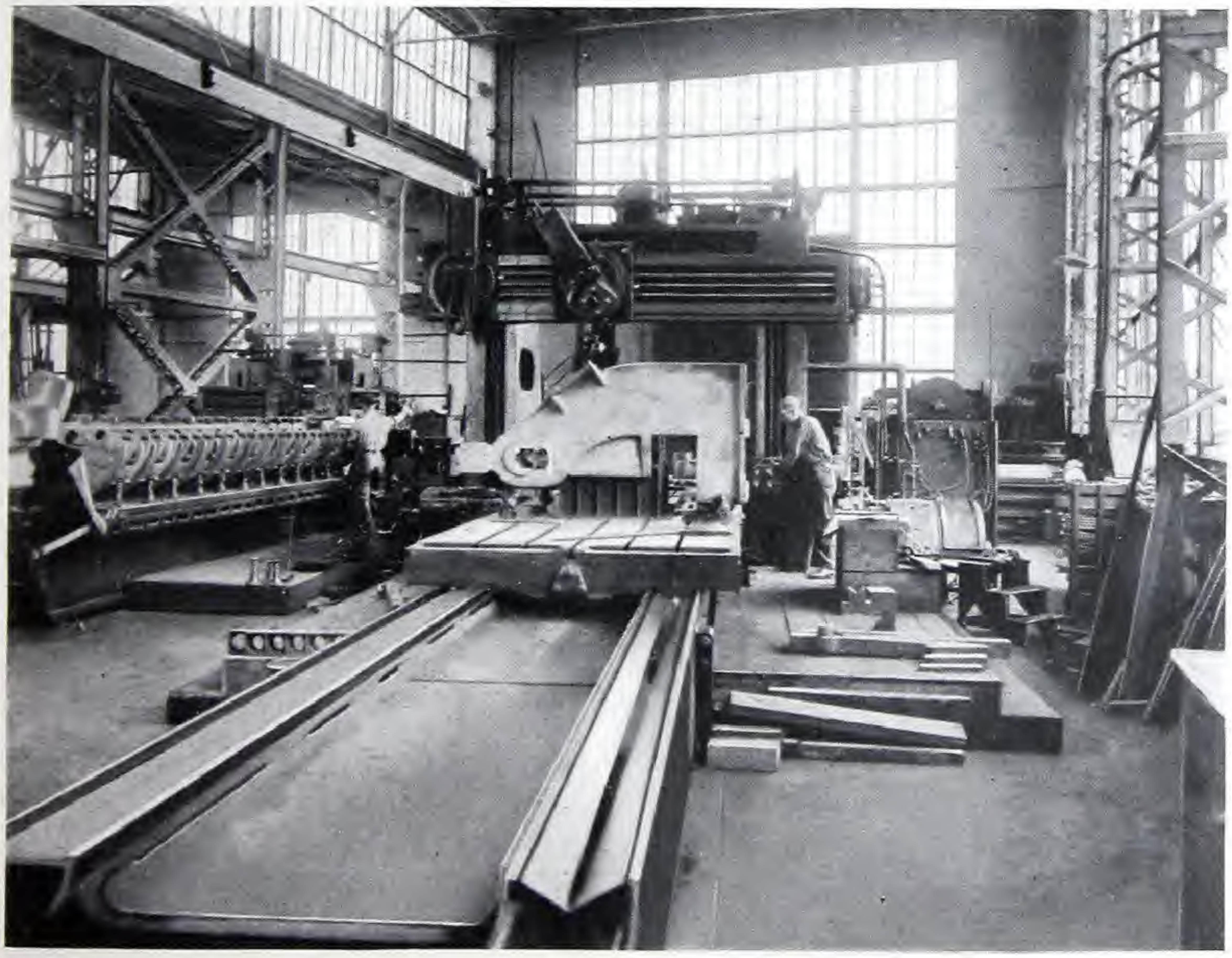
Of the three buildings here shown, embodying the principle of multiple Pond Trusses with roof inlets between them, two were built in concrete owing to war conditions. These are the Dayton-Wright Airplane Co. main building and the Olds Motor Works motor machine shop. In the former, especially, the lighting is so good that extensive motion pictures have been taken there during working hours without artificial light. The third—of the National Pneumatic Co.—is an excellent example of steel design.

Where the work involves handling objects of different size, or where cranes are required in certain bays, but not in others, it is desirable to vary the roof heights. This requires planning, so that each part of the floor shall get its share of light from at least two directions, and so that the necessary air currents shall be created. A good example is the machine shop of the Consolidated Press Co., shown on this and the next page. The main bay, where the larger castings are machined, has a clear

E. W. Bliss Co., Consolidated Press Co. branch, Hastings, Mich. Frank D. Chase, Inc., Industrial Engineers. Office building in foreground, with machine shop behind it. Beyond the machine shop are outdoor storage space, storage building for sand and pig iron, foundry and pattern shop.

height under crane hook of 28 feet. The next bay to the south has a lower roof, and the next a still lower. Each of these latter roofs has a reverse slope, to permit two lines of Pond Continuous Sash to be used above it. The north wall of the main bay is one huge window, 280 by 36 feet, and the effect is to cross-light every part of the floor. Top and bottom sash lines are arranged to open, and the ventilation throughout is excellent.

Radically different, and even more noteworthy owing to the great size of the building, is the recently built Steam Turbine Shop of the General Electric Co., at Erie, Pa. The main floor is 165 feet wide, and the entire east half is divided into two stories by a gallery floor. The west bay has a clear height of 36 feet under crane hooks; and the west wall, 800 feet long, is nearly all glass.



Consolidated Press Co. View in main or high bay of machine shop, looking toward front wall. The machine shop has three roof levels, of which the two lower have reverse slopes with Pond Continuous Sash above them. The effect of these upper lines and the unbroken window of the main bay is to give ample cross-lighting in all three bays.

The roof is a Pond Truss; and the gallery floor is abundantly lighted from roof and sidewalls. But below the gallery a low one-story extension juts out the entire length of the east wall, making the lower wall unavailable for lighting or ventilating the under-gallery floor.

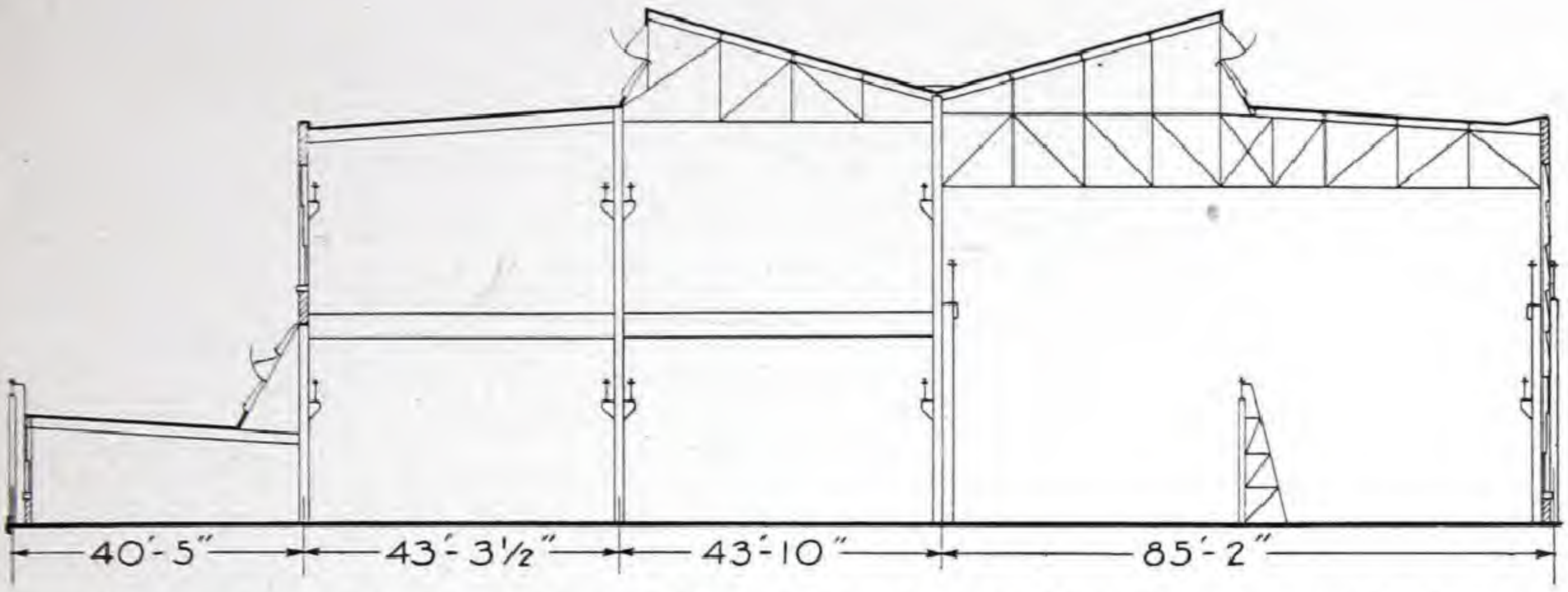
As the gallery is 87 feet wide, and fine machine work is done under it, scanty or one-direction lighting from the west wall alone was not to be

General Electric Co., Erie, Pa. Steam Turbine Shop. Messrs. Harris & Richards, Architects. Upper view is from northeast. Building is 172 ft. wide, with low one-story east extension. Lower view is taken under east gallery, showing the three sloping lines of Pond Continuous Sash between the roof of the extension and the main wall.

General Electric Co. Steam Turbine Shop. Upper view, looking north on gallery. Lower view, looking north down west or main bay. Roof is a Pond Truss, with motor-operated Pond Continuous Sash. In the west wall Lupton Counterbalanced Sash is used next to the floor, and five stationary lines of Pond Continuous Sash above.

Firestone Tire & Rubber Co., Akron, O., Mechanical Building. Osborn Engineering Co., Engineers.

By using Pond Continuous Sash it is possible to work close to the windows without need of shutting them in case of rain. Every third column breaks the sash lines. Other columns are spaced on 20 ft. centers and are set inside sash. Upper and lower lines of sash, each 56 ft. long, are connected in pairs and opened simultanously by Pond Operating Device with hand chains. See interior views below and on page 28.



Cross section, General Electric Co. Steam Turbine Shop, looking south, showing how gallery is lighted both from the east windows and from the roof; also how the space below is lighted by the west window and the sloping lines of Pond Continuous Sash.

thought of. The problem was solved by giving the roof of the extension a reverse slope, and introducing three sloping lines of "Pond Continuous Sash" between this roof and the gallery floor.

The roof lines of sash are motor-operated. In the lower west and upper east walls, and in the end walls, Lupton Counterbalanced Sash are used. Elsewhere stationary lines of Pond Continuous Sash are used, as being better suited to large unbroken glass areas than the more common factory type.

In view of the fact that most buildings having a gallery are dark or poorly ventilated at some point, the successful treatment of this building will repay careful study.

Multi-Story Buildings

Where high land values or lack of space prohibit the use of single-story or galleried buildings, the multi-story type must be used despite its inherent limitations. In consequence, much ingenuity is sometimes needed to secure maximum working efficiency from the investment in floor space.

Thus, a wide rectangular building may contain one or more light courts, each roofed over, one or two stories high, with ventilating sash.

Or the gound plan may show a series of parallel wings connected by a "backbone," instead of a rectangle.

Instead of the usual pivoted-ventilator sash, Lupton Counter-balanced Sash may be used, so that the upper and lower sash of each unit open or close together. This permits the building to be made materially wider without loss of ventilation and with resultant saving in floor rental.

Or we may go a step further, and hang lengths of Pond Continuous Sash between pilasters. Two such lengths—upper and lower— may extend across three 20 foot bays, and be operated simultaneously by one hand chain. This accomplishes four objects:

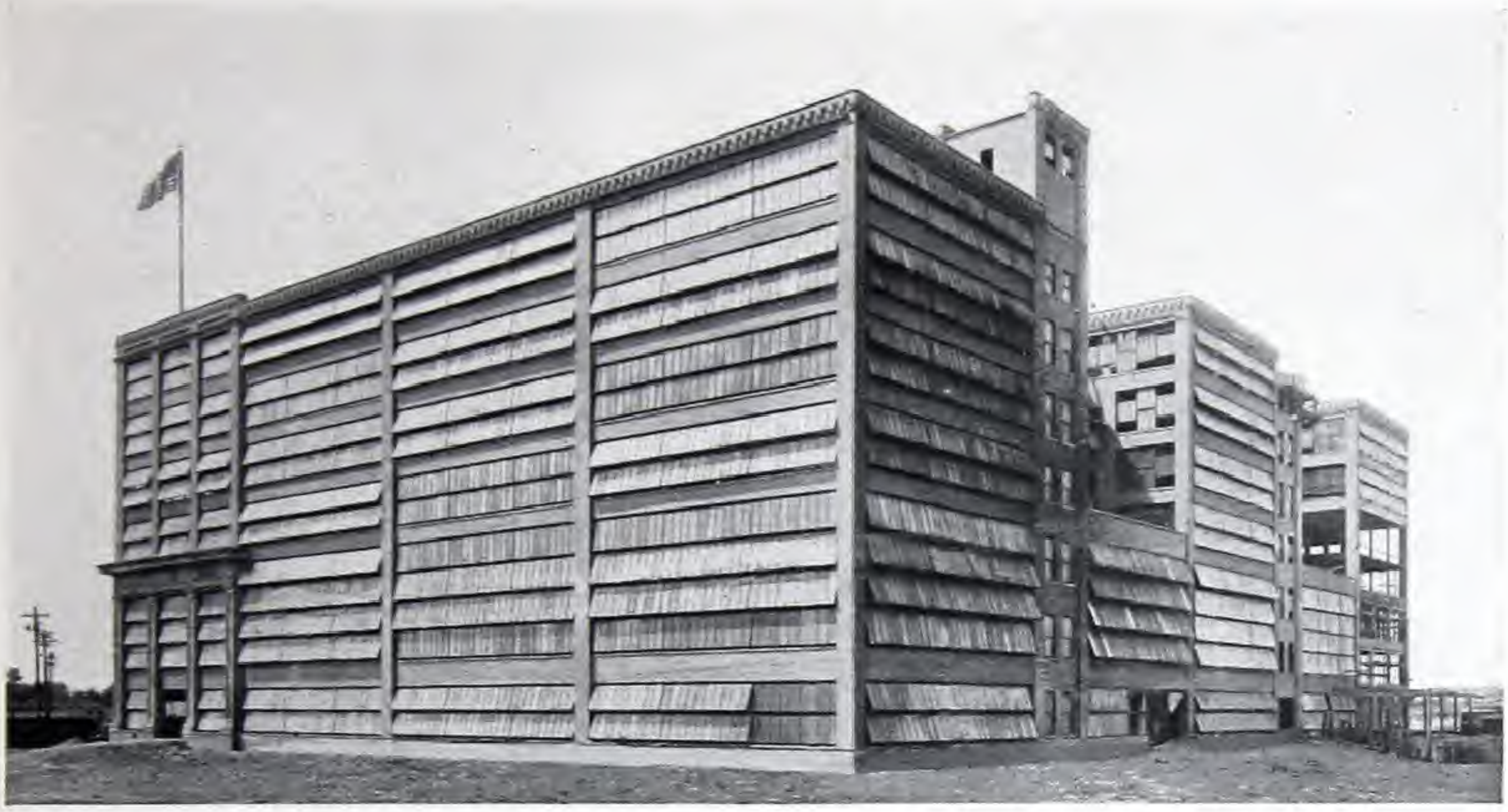
(1) Equally-balanced inlet and outlet openings under all conditions;

(2) Uniform diffusion of inflow and outflow for at least three bays;

(3) Protection for goods and equipment in all weathers, without sacrifice of ventilation;

(4) Responsibility for ventilation rests with foremen, not with individuals, hence is less likely to be neglected.

Another view in the Firestone Mechanical Building, showing pattern shop.



Firestone Tire & Rubber Co., Akron, O. Plant No. 2. Osborn Engineering Co., Engineers.

This building is interesting for its general design. Its form is that of a grid, with a central backbone running east and west. From this grid run wings each 60 ft. wide. The left doorway is at the east end of the backbone and the present three wings extend north. Others will be added as needed.

The exterior sash arrangement resembles that in the Firestone Mechanical Building. The second floor is sawtooth-roofed between the wings, Pond Continuous Sash being used. The windows overlooking the light courts are Lupton Counterbalanced Sash, there being less liability of rain driving in than in the outside walls.

Such an arrangement is not needed for every plant; but where heat or fumes are produced, or the workers are closely crowded, and where the product or equipment would suffer damage from water, this arrangement is highly valuable. Striking examples of its use by the Firestone Tire & Rubber Co. are shown on pages 26, 28 and 29.

Another device by which the productive value of a wide multi-story building may be increased is to treat the top floor as if it were a one-story building in itself, lighted and ventilated from the roof as well as from the sides. Then all the finer processes may be carried out on the top floor, under ideal conditions, while the other floors are devoted to rougher work and storage. As a rule this division will permit the building to be made wider than otherwise; and it will increase materially the production capacity from a given ground area.

A remarkable example of this—though not a machine shop—is Building No. 40 of the B. F. Goodrich Co., Akron. This building has two wings totaling 500 feet in length, and 100 feet wide. The top floor is devoted to assembling rubber footwear: about 1000 workers are intensively employed, and the rubber fumes demand ample ventilation. Each wing has a sawtooth roof; and in each roof *all operated sash lines are controlled simultaneously* by a single electric motor. Stale air does not have to hunt for an outlet: it simply ascends and passes out. For inlet, long lines of Pond Continuous Sash are provided over the sliding windows; hence distribution is as uniform as outflow even in winter. The sliding windows are Lupton Counterbalanced Sash: the sawtooth lines are Pond Continuous Sash.

From what has been said it will be apparent that the possibilities of effectively distributing light and fresh air over wide floor areas cannot be expressed in a formula: the variables are too numerous. The results of successful treatment are however so valuable as to justify almost any effort to secure them.

The experience we have gained in this work is placed freely at the service of our customers' architects and engineers, no specific charge being made for it. To this end we maintain a large Engineering Department at our Philadelphia headquarters, and a competent engineering staff also at each of our branch offices. We are always glad to discuss proposed plans with intending builders, and are often able to make suggestions of value.

The Pond Truss roof design is patented. Its use is licensed in consideration of the exclusive use of Lupton Sash Products in buildings so designed. We lay out the proportions of every Pond Truss roof to fit the conditions of the particular building.

Other Buildings

Besides machine shops, we have devoted much attention to certain other classes of buildings in which growth of unit size or intensified methods of production have brought new problems in lighting and ventilation.

Chief of these is the group of heat-producing buildings represented by foundries, forge shops, core and heat treatment buildings, rolling mills, glass factories, potteries and the like. If designed in the ordinary way these buildings are excessively hot and stifling, even in moderate widths. By correct roof design and free use of Pond Continuous Sash they may be comfortable, no matter how wide.

We have published a booklet, "Air and Light in Foundries and Forge Shops," which describes fully the ventilating action of a heat-producing building when correctly designed. A copy will be sent to any address on request.

Interior of a stove foundry 140 ft. wide. Note the exceptional lighting and ventilation due to the Pond Truss roof.

LUPTON PRODUCTS

Pond Continuous Sash

(Patented by Clarke P. Pond)

We originated Pond Continuous Sash, the first continuous steel sash, to accomplish three results:

1—To give ventilation regardless of opening;

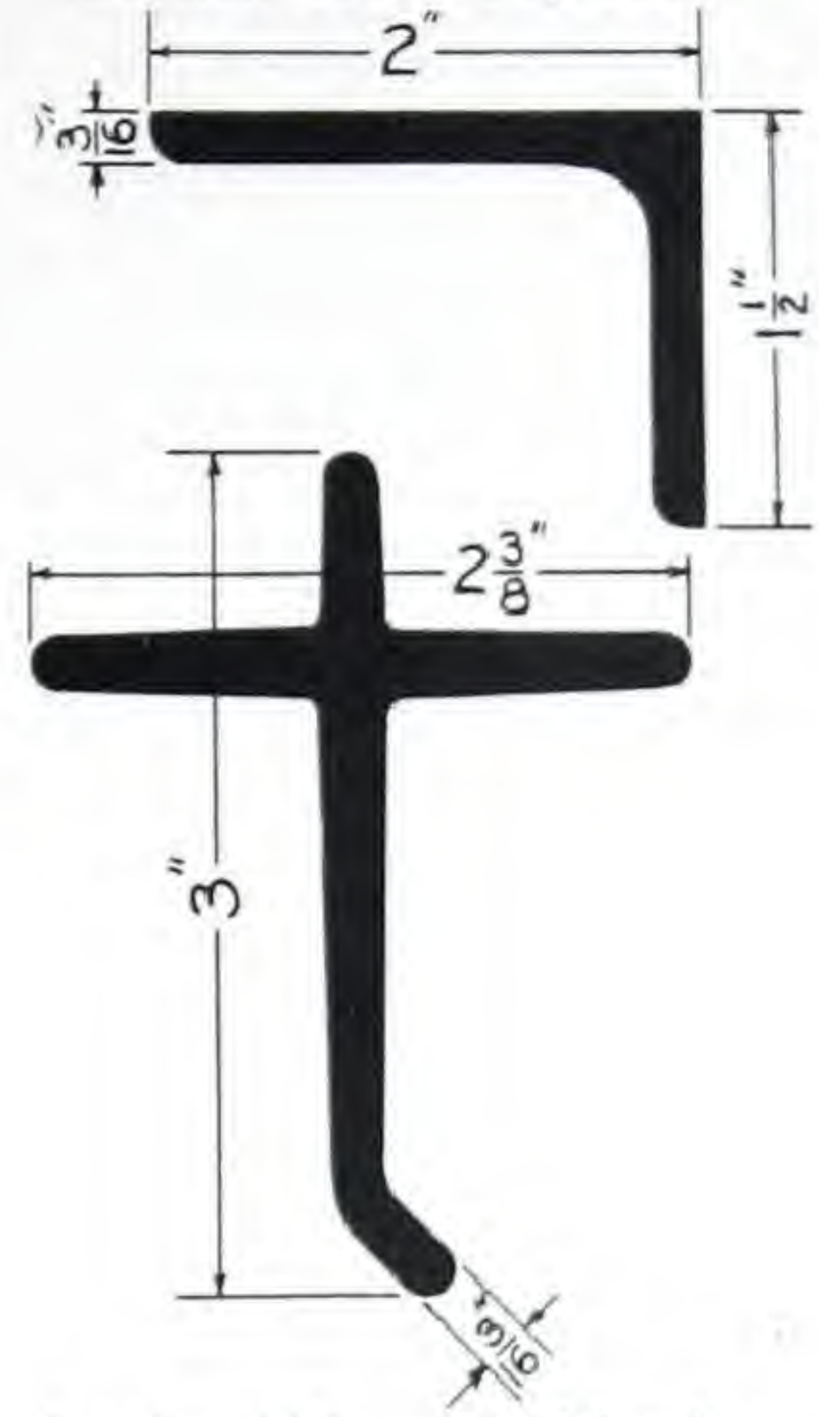
2—To give maximum effective ventilating area in proportion to glass area;

3—To give mass control of air inlets and outlets, as is often required, not only in foundries and other heat-producing buildings, but in wide manufacturing buildings also.

The weather-proof feature is obtained by hanging the sash from the top, in continuous lines outside of all structural work, where it forms a transparent shed over a variable opening. A steel angle overhangs the top edge, and stationary glass panels underlap the ends, thus excluding rain in a slanting wind.

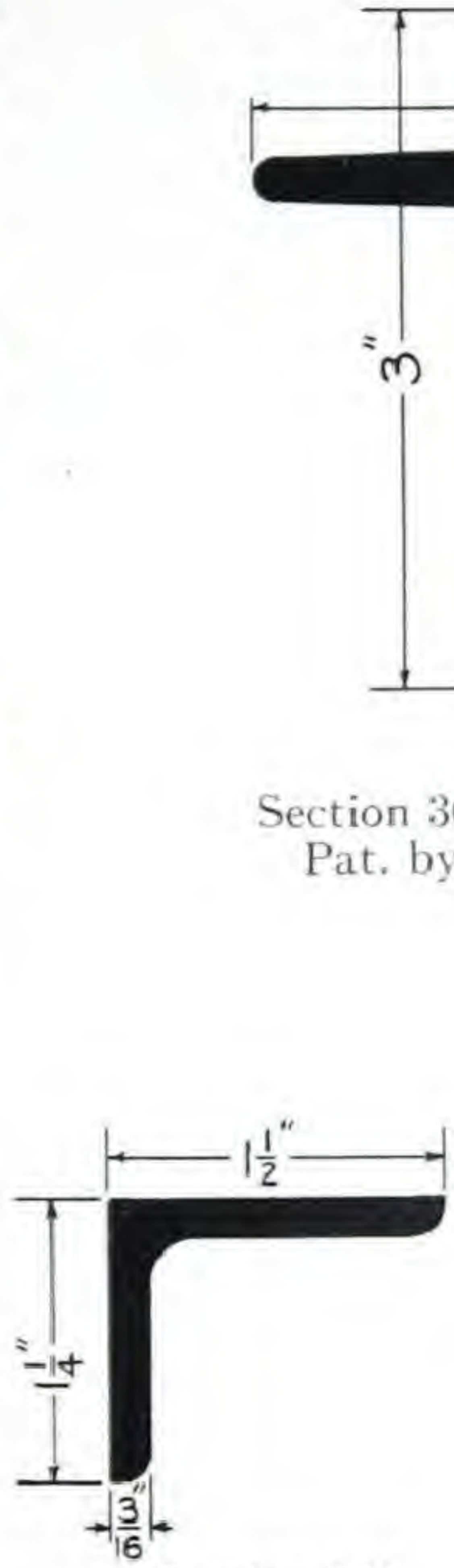
Pond Operating Device controlling lines of top hung Pond Continuous Sash in roof outlet of Lupton factory. Note spiral used with counterweights in place of idler pulleys where length of line makes it desirable. Roof is a Pond Truss.

Section 195. Top Rail

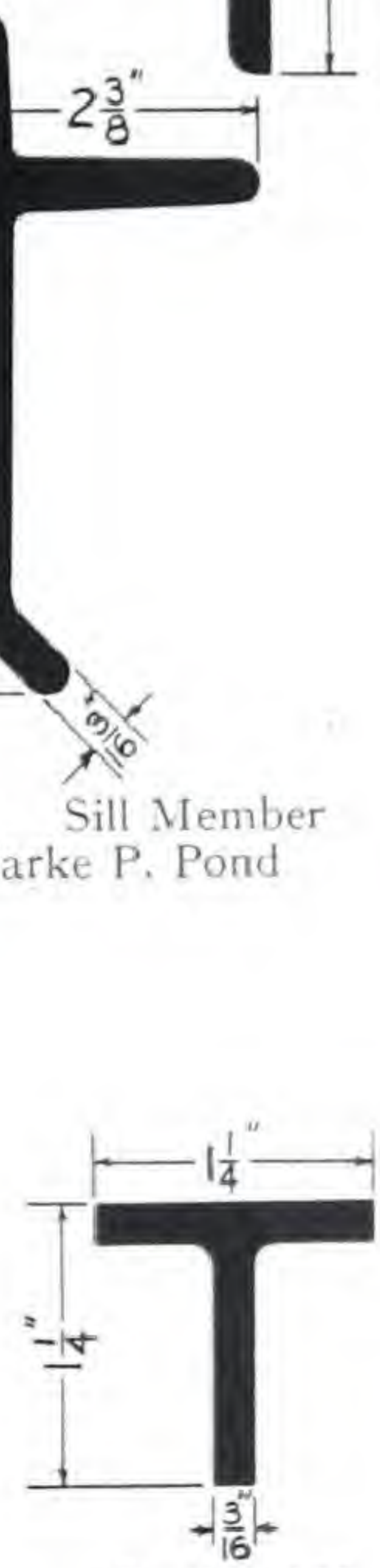


Section 307. Sill Member
Pat. by Clarke P. Pond

Above: Outside and inside views of expansion cover joining Pond Continuous Sash units. Cover is welded to top and bottom members of one unit, and is shaped to a close fit against the connecting unit, thereby practically eliminating air leakage at this point when sash are closed. Bolt in sill member works in a slot, allowing flexibility for alignment with steel work. Members are shortened for greater clearness.



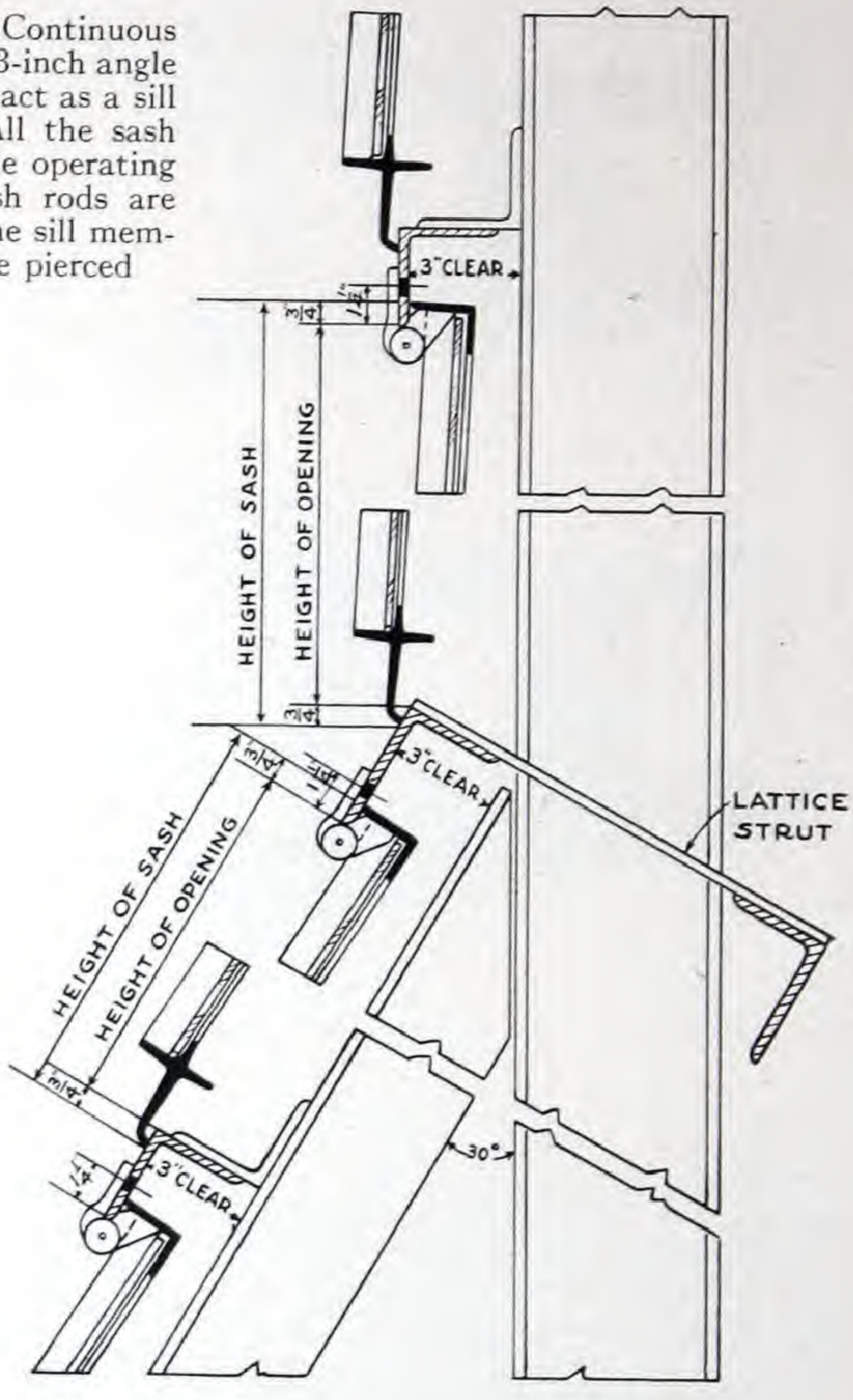
Section 350
Side Rail

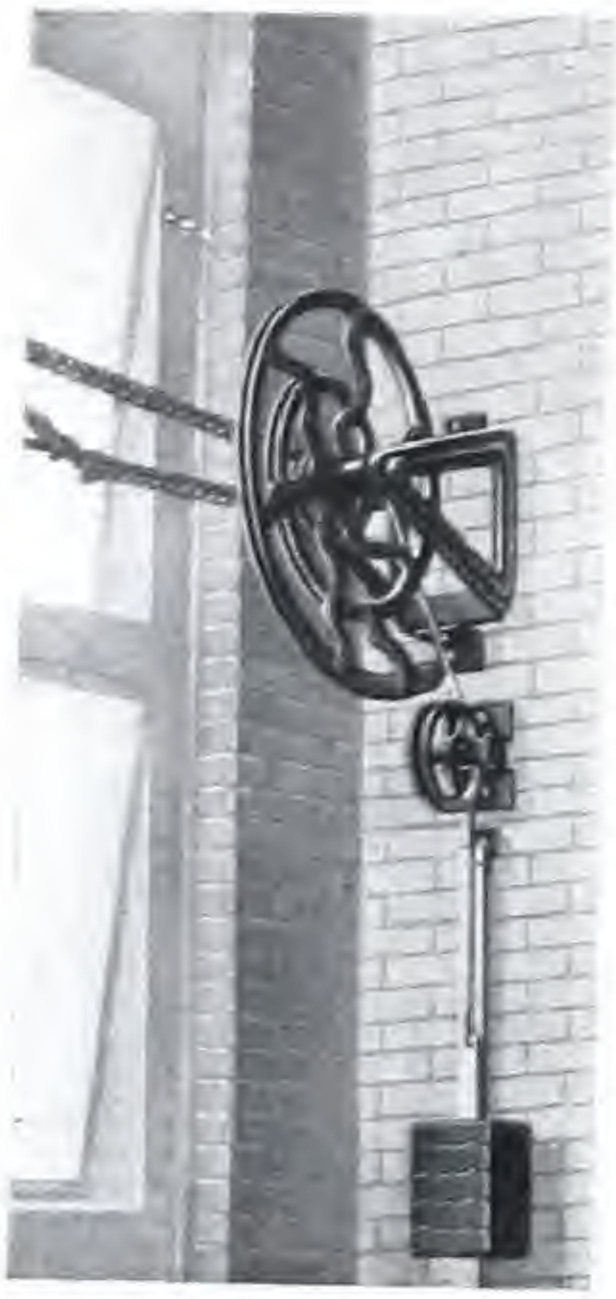


Section 125
Muntin

The value of the ventilating area given by Pond Continuous Sash is more than simply a question of width of opening. Top-hung Pond Continuous Sash, particularly when used in a Pond Truss roof, is far more effective than centre pivoted sash in preventing cross winds from blowing over the top and upsetting the ventilation. It is the least sensitive type of sash to changes in wind and weather, and hence needs the least regulation and attention.

Detail of Assembly, Pond Continuous Sash in Pond Truss outlets. A 3-inch angle is required at each head and to act as a sill for the lowest line of sash. All the sash are usually operated, though the operating device is not shown. The sash rods are attached to the inner wing of the sill member. Drip holes, not shown, are pierced in the outer wing.





Spiral and counterweight used in place of idler for long lines of sash. See page 37.

With the Pond Operating Device, described on pages 36 to 37, it enables large floor areas to be ventilated with the least practicable effort. That device, from its low friction and graduated thrust against the sash, opens the sash wider and with less effort and wear and tear than any other form of operator.

Where large floor areas are to be ventilated it is advisable to balance the weight of the sash, in order to control the longest practicable lines by one hand gear. See illustration of spiral and counterweight above. For very large buildings the use of electric motors makes correct regu-

lation certain by making it easy. In this way one responsible foreman can control the ventilation over thousands of square feet of floor space from a single station.

Pond Continuous Sash is made of one-piece rolled sections, much heavier than used for ordinary sash, which are rigidly welded into units of 20-foot standard length. Weather proof expansion joints connect the units into unbroken lines with enough flexibility to allow for errors in alignment of structural work. For the ends, where needed, units 10, 12, etc., feet are furnished. Beyond each end is a 2-foot stationary panel connecting to the underlapping glass storm panel. Roof openings are therefore 14, 16, etc., feet wide, up to hundreds of feet if desired.

The hinge arrangement used causes the top member to close tight against the stationary angle bar when the sash is shut. The hinges are malleable iron, with bronze pins.

The patented sill member was designed for this special purpose. Its shape allows drip holes to be pierced in the outer flange, so that putty is not required to prevent water from being retained when the sash is opened. Our experience is that putty cannot be trusted for this purpose, as it tends to dry out and break away, resulting in local corrosion.

Another feature of the sill member is that the wings, owing to their position opposite each other, sustain the thrust of the operator without distortion of the sill member or undue strain on the glass.

The ventilating value of continuous sash depends not only on its ability to exclude rain or snow when open but upon the effective width of opening. The Pond Operating Device is so designed as to give a wider opening with less applied force than any other device made. The following table gives width of openings of Pond Continuous Sash in the various sizes, where the Pond Operating Device is used:

No. 3 sash, 3 ft. high, 46° or 28″.

No. 4 sash, 4 ft. high, 47° or 38″.

No. 5 sash, 5 ft. high, 42° or 43″.

No. 6 sash, 6 ft. high, 36° or 44″.

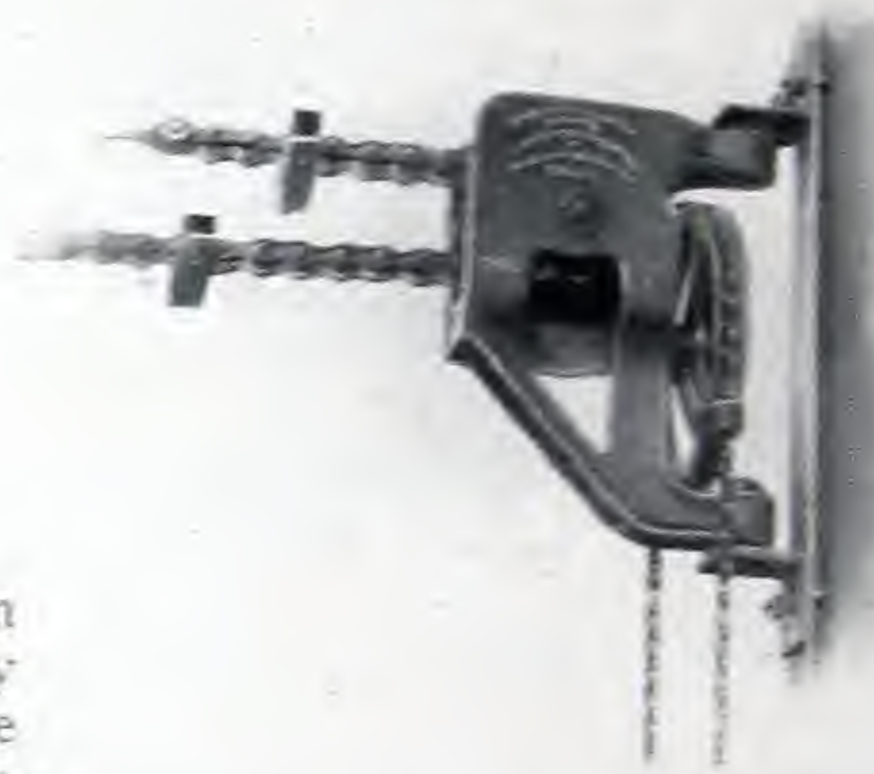
Pond Continuous Sash is carried in stock in all standard sizes in our Philadelphia, Cleveland, Chicago, Detroit and Atlanta warehouses. For a complete technical description see our catalogue No. 10-PCS.

Pond Operating Device

(Patented by Clarke P. Pond)

The Pond Operating Device is especially designed to operate long lines of continuous sash, also pivoted ventilators in lines or groups.

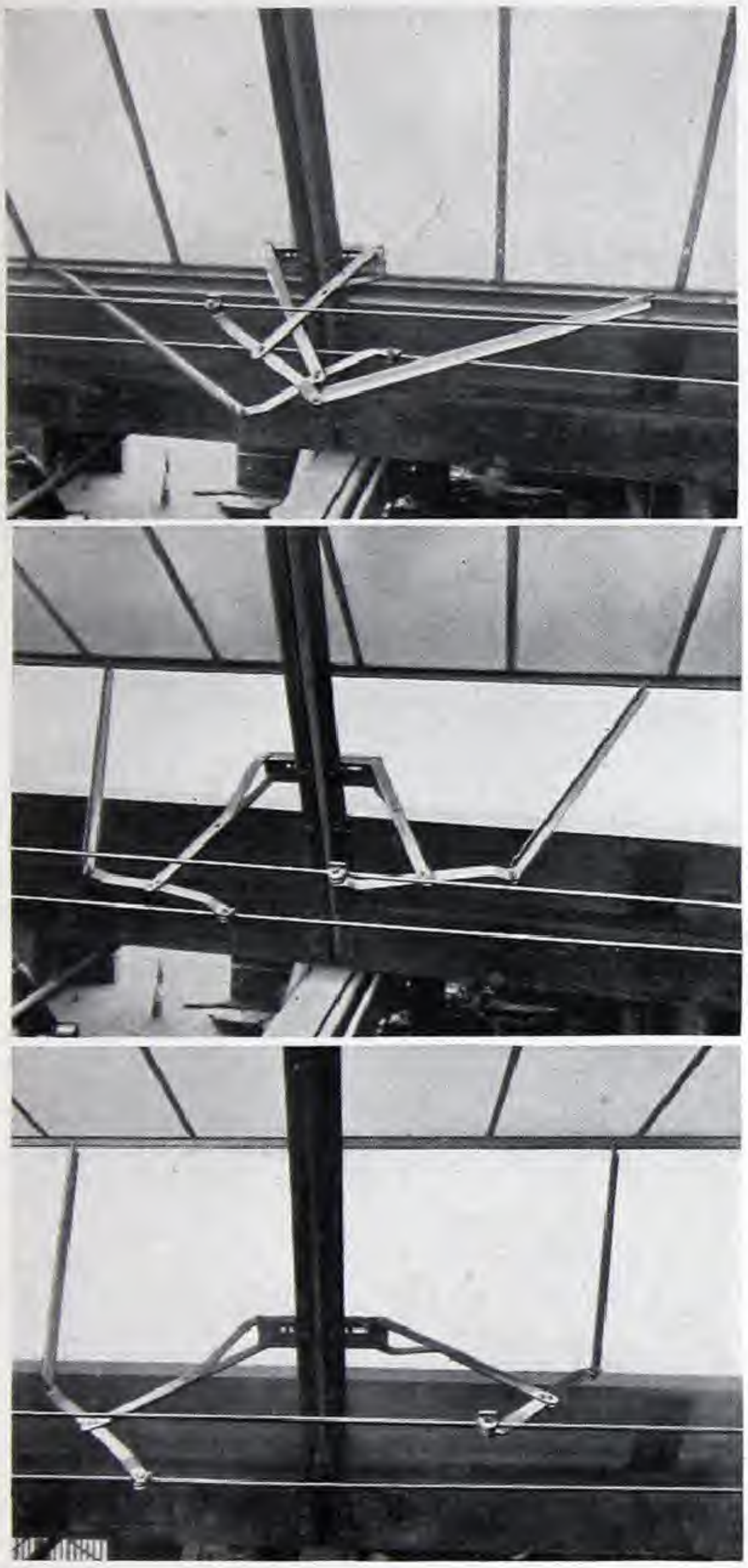
A hand chain operates a worm and gear, from which lengthwise motion is imparted by a sprocket to a pair of tension rods, connected at their far ends to a chain running over an idler. To these rods are attached compound lever arms exerting a thrust against the lower member of the sash. This thrust is angular at first but increasingly direct as the sash is raised, hence the lifting effort is most effective when the greatest weight is overcome.



Operating gear and idler at end of tension rods. Upper and lower rods are continually under tension and the work of operating the sash is equally divided between them. See photographs on next page. The worm and gear are cut from steel and run in oil in a dust-proof case. For long lines counterweights and spirals are used instead of idlers, to counterbalance the increasing load as sash is raised. See page 34.

The rods are always in tension, and the load is divided equally between them as shown in the three views showing the sash from shut to open. The principle of tension transmission, with balanced thrust against the sash, largely accounts for the extremely low friction of the device.

The worm and gear are accurately cut from steel and run in a dust-proof and oil-tight case. Ball bearings are used on the worm shaft. The hinged connections of the lever arms are bushed with phosphor bronze.



For long lines it is preferable to use spirals and counterweights (see illustration, p. 34) to balance the weight of the sash, instead of dividing the lines and using two hand gears for each. The fewer and more easily operated the gears, the less labor is required to open or close the sash.

For unusually long lines, or to operate a number of lines together, we recommend Pond Operating Device, Motor Driven, with spiral and counterweight. This embodies an A.C. motor especially wound for high starting torque. An automatic cut-out limits the movement of the sash in each direction, and the sash may be controlled by the switch to stand at any degree of opening desired. The spiral and counterweight permit a smaller motor to be used, and give a uniform motor load and speed from start to stop in either direction.

Catalogue 10-PCS gives full description.

Tension rods and compound levers of Pond Operating Device. Three positions: closed, partly open and fully open. Note increasingly direct thrust as sash is opened.

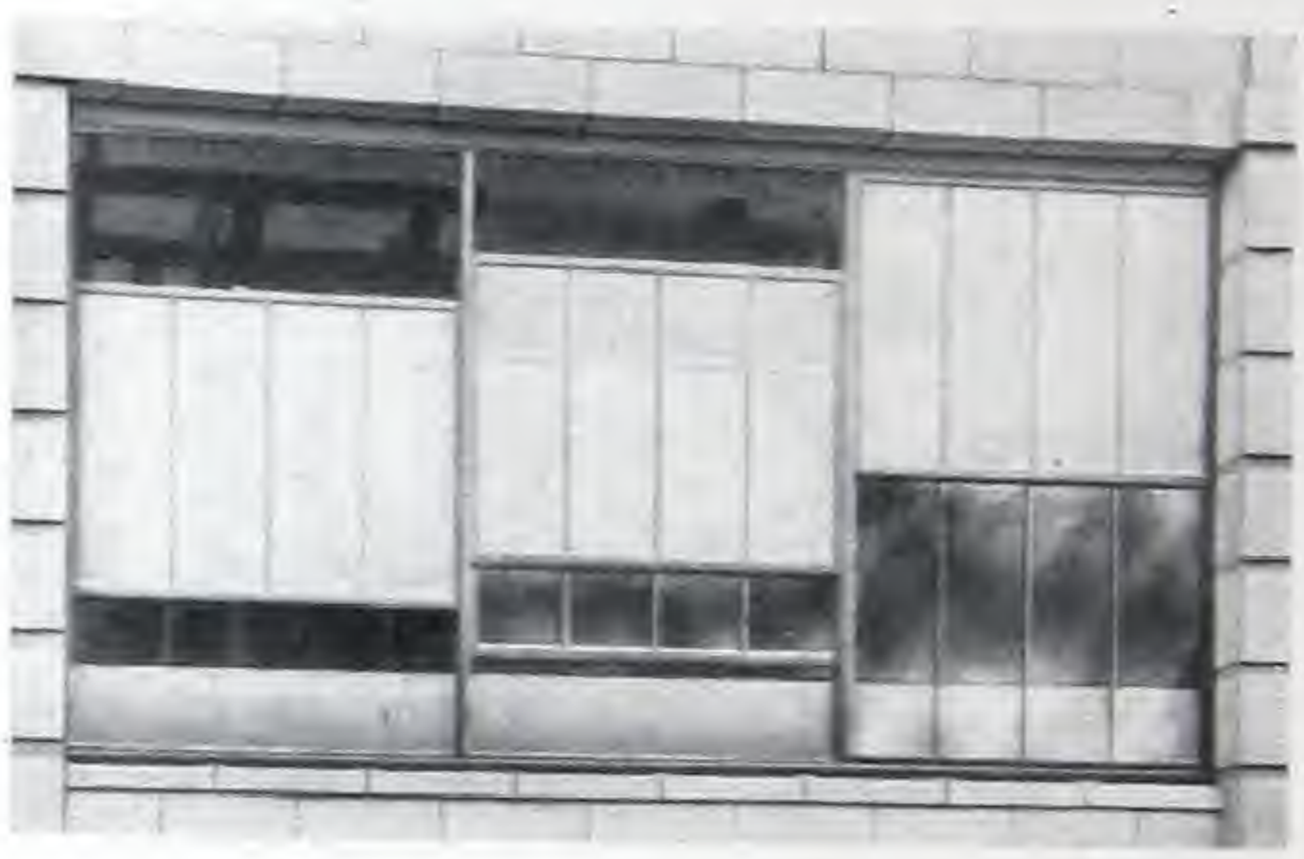
Enclosed gearing and electric motor of Pond Operating Device. Motor Driven.

Lupton Counterbalanced Steel Sash

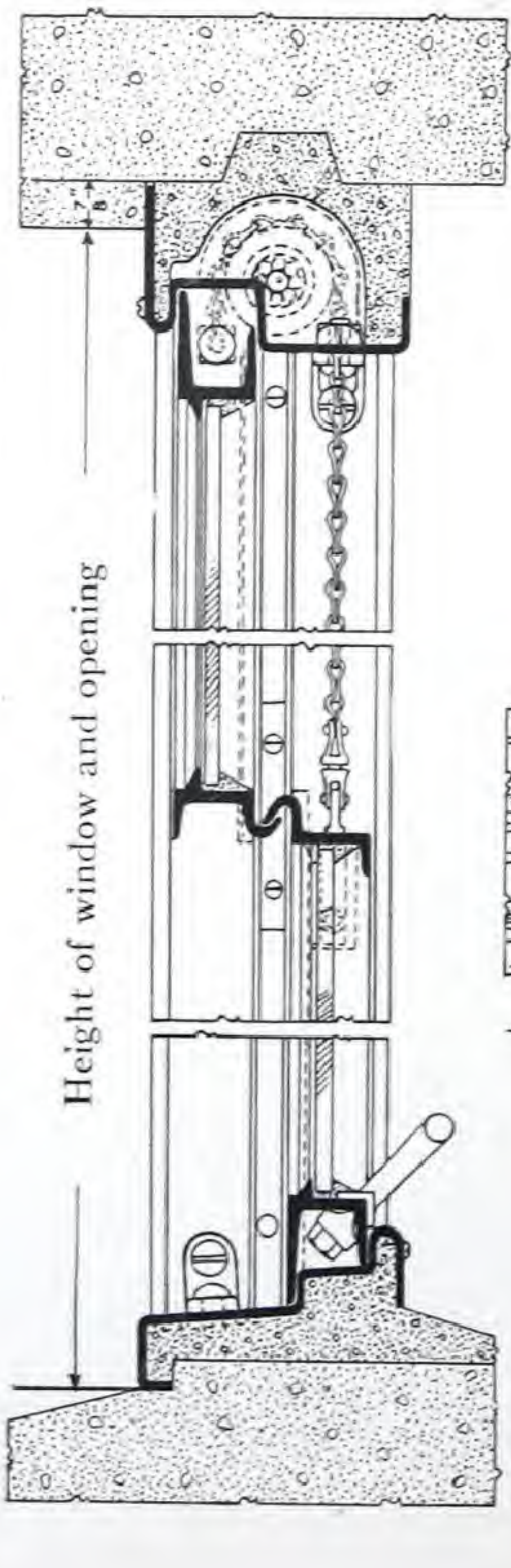
(Patented)

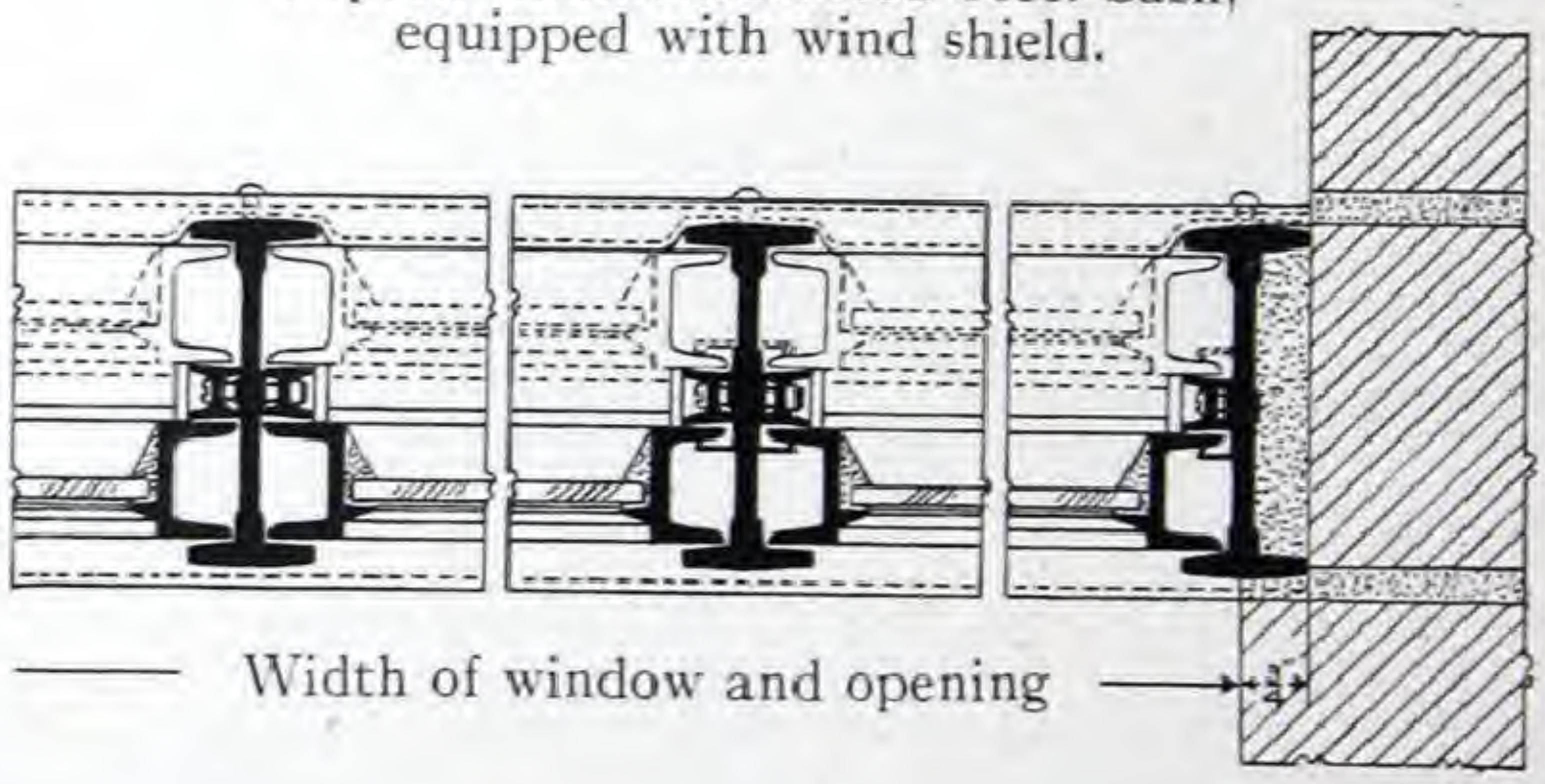
Lupton Counterbalanced Sash is much more rigid and substantial, more accurately fitted and more durable, than the ordinary pivoted ventilator type of sash. It does not interfere with cranes or with work close to the walls when open; it gives a large ventilating area; it is readily shaded; and it is more than ordinarily weather tight when shut.

The feature which distinguishes counterbalanced from counter-weighted sash is the fact that, in the former, the top and bottom sash are



Lupton Counterbalanced Steel Sash, equipped with wind shield.

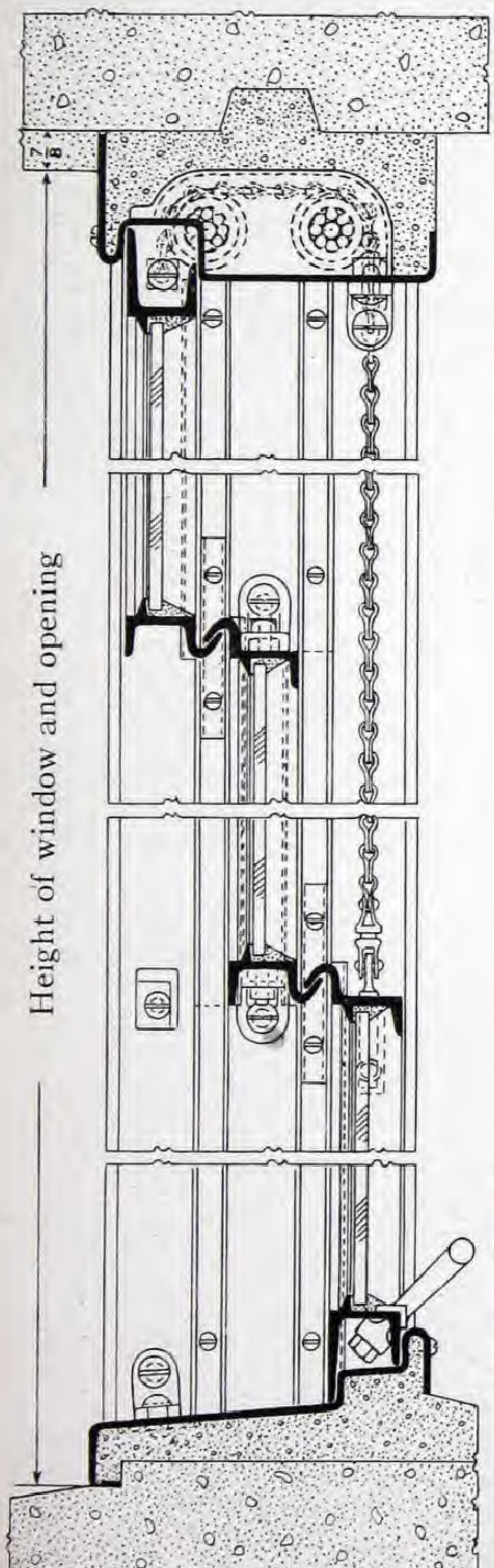




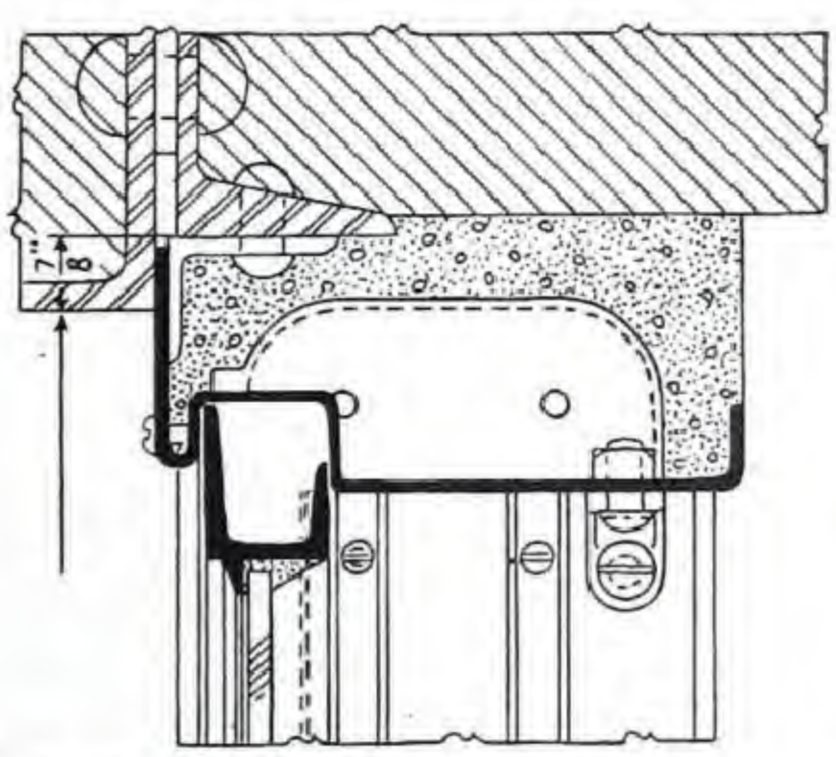
Vertical and Horizontal Sections of 2-high Lupton Counterbalanced Steel Sash.

The weathertight formation at head, meeting rails and sill without the use of weather stripping, is noteworthy.

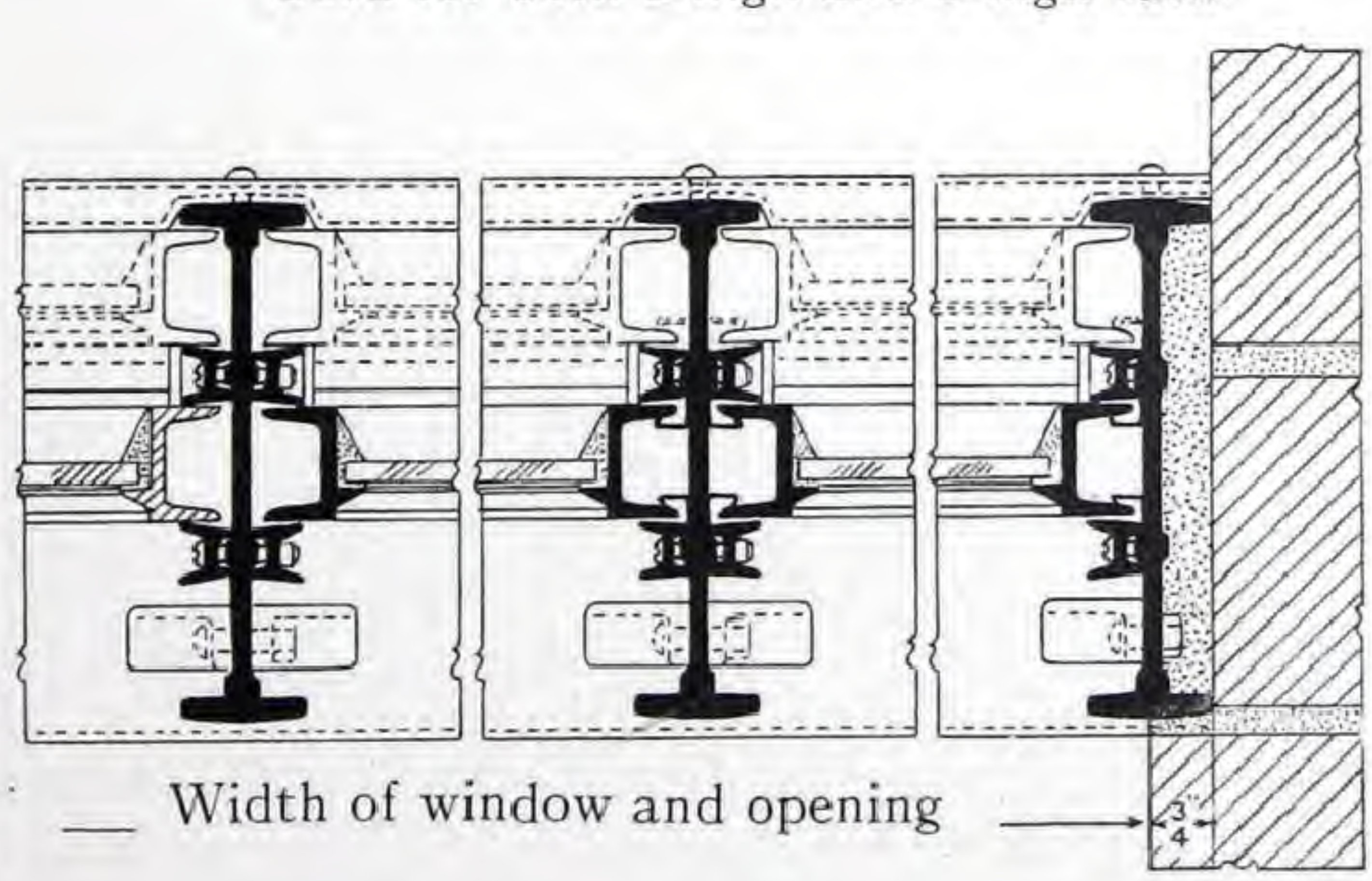
hung over a single pair of pulleys, so that they move simultaneously in opposite directions, giving equal top and bottom openings with one movement. In foundries and forge shops this feature is valuable for the large ventilating area thereby secured, amounting in the "2-high" type to half of the glass area, and in the "3-high" type to two-thirds of the glass area.



Lupton Counterbalanced Sash is made from heavy rolled steel sections, of such form as to ensure weather tightness at head, jambs, meeting rails and sill without the addition of weather strips. Being rolled in one piece, these sections are more accurate in shape than assembled sections and are free from internal corrosion. The latter applies also to the sash corners, which are electrically welded over the entire area



Detail for steel lintel in brick wall.
Used for both 2-high and 3-high sash.



of contact into permanently rigid units. Attention is called to the form of head and sill, the latter of which has a double rise and is keyed with the cement to prevent warping and leakage.

We make this sash for standard glass widths 14, 16, 18, 20, 22 and 24 inches, and standard glass heights 30, 36, 42, 48, 50, 54, 60, 66 and 72 inches. Any combination of width and height of glass can be given.

Single units are made 2, 3 and 4 lights wide, with opening widths from 3 ft. 9 in. to 6 ft. 3 in. Opening heights for "2-high" sash are approximately from 5½ ft. to 12½ ft.; for "3-high" sash approximately from 8 ft. to 19 ft. Blueprint showing exact dimensions will be sent on request.

No horizontal muntins are used unless specified. Appearance is improved and glass cleaning simplified by omitting them.

Special shade brackets can be furnished, to hang shades 12 in. in from jambs in order to permit air movement over upper sash.

When desired, we furnish these sash to conform to the specifications of the Board of Underwriters and bearing the underwriters' label. An extra charge is made for this.

See catalogue No. 10-LBC for full description.

Lupton Pivoted Factory Sash

(Patented)

This is a high-grade pivoted-ventilator sash, which is suited to all uses to which this type of sash may appropriately be put.

It is made in a variety of standard sizes, the cut bars for which are carried in factory stock ready for assembling.

The most-used standard sizes are carried also in warehouse stock, fully assembled, in Philadelphia, Cleveland and Detroit. Under normal conditions shipments can be made immediately of average orders for these stock sizes.

Lupton Factory Sash is fully described in our catalogue No. 10-LSS, which also lists the standard and special sizes, and shows the opening dimensions required.

For mass ventilation in large buildings, or in heat-producing buildings, the ventilators should be connected in lines or groups, and operated by a special form of Pond Operating Device.

DESIGNING FACTORIES FOR LIGHT AND VENTILATION

Many recent factories are well lighted but badly ventilated. We have for some years made a study of air movements in single and multi-story factory buildings, and have developed certain ways of using both Lupton Counterbalanced Sash and Pond Continuous Sash with unusual ventilating results. A number of famous factories in which these principles are applied are described in a 48-page booklet, Air, Light and Efficiency." It is free on request.

AIR AND LIGHT IN POWER HOUSES

Most large boiler rooms are dark and hot for the same reason—unscientific roof design. It is entirely practicable to design the roof of even the largest power station so that it will admit light and discharge heated air through lines of constantly-open continuous sash located just above the top of the boilers but below the side walls of the overhead bunkers. That is the basic feature of the Pond Truss, Power House Type, used in the Lake St. Power House, Cleveland, to light and ventilate a boiler room of 54 boilers arranged in three double rows. This power house is fully described, with several others, in our booklet, "Air and Light in Power Houses," sent free on request.

VENTILATION IN HEAT-PRODUCING BUILDINGS

Such buildings as foundries, forge shops, rolling mills, glass factories and dye works present special problems in ventilation. For such buildings the weather protection and mass control of Pond Continuous Sash have been found especially useful.

We have given great attention to the design of these buildings, and more than 100 foundries and forge shops alone have been built following our recommendations. This work is more fully described in a booklet entitled "Air and Light in Foundries and Forge Shops," which will be sent free on request.

[BLANK PAGE]

[BLANK PAGE]

INTERNATIONAL

Lupton

INVESTMENT VALUE